DETAILED ACTION

Response to Arguments

Applicant's arguments filed 02/25/2008 have been fully considered but they are not persuasive.

In response to the first applicant's argument on page 6-7, the applicant alleges that Kumakura teaches "a reduction in ohmic contact resistance was obtained by adding the InGaN contact layer between the electrode and the p-type GaN base layer. See Abstract. In other words, the reason that contact resistance with the Kumakura electrode was less was because the electrode was formed directly on a p-type InGaN contact layer instead of the p-type GaN base layer"

The examiner respectfully disagrees because the applicant does not explicitly claim the p-type base layer is a p-type InGaN in the previous claims 50 and 81. Thereof, it would have been obvious to one having ordinary skills in the art at the to combine the p-type InGaN contact layer formed directly on between the electrode and the p-type base layer disclosed in Kumarkura with the nitride semiconductor structure of Makimoto in order to improve the device performance as the reason stated by the Examiner in the previous Office Action.

In the response filed on 02/19/2008, the applicant amends claims 50 and 81 to be more specific that the p-type base layer is a p-type InGaN, which necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**.

Claim Objections

Claim 84 is objected to because of the following informalities: Claim 84 is dependent from a cancelled claim 83. For the remainder of this Action, claim 84 is temporarily assumed to be dependent from claim 81.

Appropriate correction is required.

Claims 51, 54, 57, 59, 60, 86, 87, 88, 89 are objected to because of the following informalities:

The limitation "the p-type nitride semiconductor layer" in lines 1-2 of those claims is suggested to change as-- "said indium-containing p-type nitride semiconductor layer". Because the phrase recites "an indium-containing p-type nitride semiconductor layer" appears in lines 6 of claim 50. Thereof, the phrase in lines 1-2 of the claims 51, 54, 57, 59, 60, 86, 87, 88, 89 is need to stay consistent with the claimed language as stated in claim 50.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 50, 51, 53, 55, 56, 58, 77-82, 85-89 are rejected under 35 U.S.C. 102(b) as being anticipated by Makimoto (US 2002/0195619; hereinafter Makimoto)

Regarding **claim 50**, Makimoto disclose a nitride semiconductor structure (fig. 10) comprising on a substrate (item 101):

an n-type collector layer (item 104);

a p-type base layer (refer to the lower half portion of 106) formed over said n-type collector layer (104), wherein said p-type base layer (106) is p-type InGaN;

an n-type emitter layer (107) formed over said p-type base layer (refer to the lower half portion of 106),

an indium-containing p-type nitride layer (refer the upper half portion of 106) formed directly on p-type base layer (refer to the lower half portion of 106) so as to contact a top surface of said p-type surface (NOTE: the upper half portion of 106 contacted to a top surface of the lower half portion of 106), the top surface (refer to the exposed surface of the lower portion 106) having been exposed by etching said n-type emitter layer (107), wherein said indium-containing p-type nitride semiconductor (refer the upper half portion of 106) is formed on said top surface (NOTE: refer the upper half portion of 106 formed on the exposed surface of the lower portion106); and

a base electrode (109) formed on the indium containing p-type nitride semiconductor layer (refer to the upper half portion 106).

The limitation "having been exposed by etching said n-type emitter layer" (as noted in lines 7-8 of claim 50) and the phrase "regrown on" (as cited in line 9 of claim

50) refer to a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck 177 USPQ 523; In re Fessman 180 USPQ 324; In re Avery 186 USPQ 161; In re Wertheim 191 USPQ 90; and In re Marosi et al 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process claim, and not the patentability of the process, and that an old product produced by a new method is not patentable as a product, whether claimed in "product by process claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Regarding **claim 51**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches said p-type nitride semiconductor layer (refer to the upper portion of p-type InGaN 106).

Regarding **claim 53**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teach said p-type InGaN base layer has an indium mole fraction of 5-30% (see fig. 10 exhibits the p-type InGaN base containing 6% of Indium).

Regarding **claim 55**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teach said p-type base layer is p-type InGaN (see claim 52's rejection).

Regarding **claim 56**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teach said p-type InGaN base layer has an indium mole fraction of 5-30% (see claim 53's rejection).

Regarding **claim 58**, Makimoto and Kumakura et al. disclose all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teach said p-type InGaN base layer has an indium mole fraction of 5-30% (see claim 53's rejection).

Regarding **claim 77**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set forth above. Furthermore, Fig. 10 of Makimoto shows a graded layer (105) between the p-type base layer (106) and the n-type collection layer (item 104); wherein the graded layer (106) has its indium mole fraction varied gradually (see par.[0009],lines 1-3).

Regarding **claim 78**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set forth above. Furthermore, Fig. 10 of Makimoto shows a graded layer (105) between the p-type base layer (106) and the n-type collection layer (item 104); wherein the graded layer (105) has its indium mole fraction varied gradually (see par.[0009],lines 1-3).

Regarding **claim 79**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set forth above. Furthermore, Fig. 10 of Makimoto shows a graded layer (105) between the p-type base layer (106) and the n-type collection layer (item 104); wherein the graded layer (105) has its indium mole fraction varied gradually (see par.[0009],lines 1-3).

Regarding **claim 80**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set forth above. Besides, fig. 10 of Makimoto shows

the base electrode (109) is formed directly on said indium-containing p-type nitride semiconductor (refer to the upper portion of 16).

Regarding **claim 81**, Makimoto discloses a nitride semiconductor structure (fig. 10) comprising:

an n-type collector layer (item 104);

a p-type base layer (refer to the lower half portion of 106) formed over said n-type collector layer (104), wherein the p-type base layer (refer to the lower half portion of 106) has an etched top surface (refer to the exposed portion of the lower portion 106) and is p-type InGaN (106);

an n-type emitter layer (107) formed over said p-type base layer (refer to the lower half portion 106);

an indium-containing p-type nitride semiconductor layer (refer to the upper half portion 106) formed directly on the etched top surface of the p-type base layer (refer to the exposed portion of the lower portion 106); and

a base electrode (109) formed over said indium-containing p-type nitride semiconductor layer (refer to the upper half portion 106).

Regarding **claim 82**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches said indium-containing p-type nitride semiconductor layer (refer to the upper portion of 106) is p-type InGaN.

Regarding **claim 85**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Furthermore, fig. 10 of Makimoto

shows a graded layer (105) between said p-type base layer (refer to the lower portion of 106) and n-type collector layer (104).

Regarding **claim 86**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches the p-type nitride semiconductor layer (refer to the upper half portion of 106) has a thickness of between 1 and 1000nm (NOTE: fig. 10 exhibits that the thickness of 106 is 100nm; thereof, half of the thickness 106 is 50 nm).

Regarding **claim 87**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches the p-type nitride semiconductor layer has a thickness of between 1 and 100nm NOTE: fig. 10 exhibits that the thickness of 106 is 100nm; thereof, half of the thickness 106 is 50 nm).

Regarding **claim 88**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches the p-type nitride semiconductor layer (refer to the upper portion of 106) has a thickness of between 1 and 1000nm (NOTE: fig. 10 exhibits that the thickness of 106 is 100nm; thereof, half of the thickness 106 is 50 nm).

Regarding **claim 89**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above. Besides, Makimoto teaches the p-type nitride semiconductor layer (refer to the upper half portion of 106) has a thickness of between 1 and 100nm (NOTE: fig. 10 exhibits that the thickness of 106 is 100nm; thereof, half of the thickness 106 is 50 nm).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 54, 57, 59, 60, 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Makimoto, in view of K. Kumakura, T. Makimoto and N. Kobayashi, Low-Resistance Nonalloyed Ohmic Contact to p-type GaN Using Strained InGaN Contact Layer, Applied Physics Letters, Vol. 79, No. 16, pp 2588-2590 (2001).

Regarding **claim 54**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above except for said p-type nitride

semiconductor layer has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer.

Kumakura exhibits that the contact resistance decreased with increase In mole fraction of p-type InGaN contact up to 0.19 (see p. 2589, col. 1, paragraph 1).

Thereof, it would have been obvious to one having ordinary skills in the art at the time the invention was made to combine the teaching of Kumrakura in the nitride semiconductor device structure of Makimoto in order to reduce the contact resistance (see p. 2589, col. 1, paragraph 1).

The combination of Makimoto and Kumakura teaches said p-type nitride semiconductor layer (according to Kumakura, the InGaN layer having In mole fraction from 0.14-0.23 as recited in col.2, line 12) has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer (according to Makimoto, the indium mole fraction of p-InGaN base is 6% as shown in fig. 10).

Regarding **claim 57**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above except for said p-type nitride semiconductor layer has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer.

Kumakura exhibits that the contact resistance decreased with increase In mole fraction of p-type InGaN contact up to 0.19 (see p. 2589, col. 1, paragraph 1).

Thereof, it would have been obvious to one having ordinary skills in the art at the time the invention was made to combine the teaching of Kumrakura in the nitride

semiconductor device structure of Makimoto in order to reduce the contact resistance (see p. 2589, col. 1, paragraph 1).

The combination of Makimoto and Kumakura teaches said p-type nitride semiconductor layer (according to Kumakura, the InGaN layer having In mole fraction from 0.14-0.23 as recited in col.2, line 12) has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer (according to Makimoto, the indium mole fraction of p-InGaN base is 6% as shown in fig. 10).

Regarding **claim 59**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above except for said p-type nitride semiconductor layer has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer.

Kumakura exhibits that the contact resistance decreased with increase In mole fraction of p-type InGaN contact up to 0.19 (see p. 2589, col. 1, paragraph 1).

Thereof, it would have been obvious to one having ordinary skills in the art at the time the invention was made to combine the teaching of Kumrakura in the nitride semiconductor device structure of Makimoto in order to reduce the contact resistance (see p. 2589, col. 1, paragraph 1).

The combination of Makimoto and Kumakura teaches said p-type nitride semiconductor layer (according to Kumakura, the InGaN layer having In mole fraction from 0.14-0.23 as recited in col.2, line 12) has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer (according to Makimoto, the indium mole fraction of p-InGaN base is 6% as shown in fig. 10).

Regarding **claim 60**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above except for said p-type nitride semiconductor layer has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer.

Kumakura exhibits that the contact resistance decreased with increase In mole fraction of p-type InGaN contact up to 0.19 (see p. 2589, col. 1, paragraph 1).

Thereof, it would have been obvious to one having ordinary skills in the art at the time the invention was made to combine the teaching of Kumrakura in the nitride semiconductor device structure of Makimoto in order to reduce the contact resistance (see p. 2589, col. 1, paragraph 1).

The combination of Makimoto and Kumakura teaches said p-type nitride semiconductor layer (according to Kumakura, the InGaN layer having In mole fraction from 0.14-0.23 as recited in col.2, line 12) has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer (according to Makimoto, the indium mole fraction of p-InGaN base is 6% as shown in fig. 10).

Regarding **claim 84**, Makimoto discloses all the limitations of the claimed invention for the same reasons as set-forth above except for said p-type nitride semiconductor layer has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer.

Kumakura exhibits that the contact resistance decreased with increase In mole fraction of p-type InGaN contact up to 0.19 (see p. 2589, col. 1, paragraph 1).

Thereof, it would have been obvious to one having ordinary skills in the art at the time the invention was made to combine the teaching of Kumrakura in the nitride semiconductor device structure of Makimoto in order to reduce the contact resistance (see p. 2589, col. 1, paragraph 1).

The combination of Makimoto and Kumakura teaches said p-type nitride semiconductor layer (according to Kumakura, the InGaN layer having In mole fraction from 0.14-0.23 as recited in col.2, line 12) has an indium mole fraction higher than an indium mole fraction of said p-type InGaN base layer (according to Makimoto, the indium mole fraction of p-InGaN base is 6% as shown in fig. 10).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tram Hoang Nguyen whose telephone number is (571)272-5526. The examiner can normally be reached on Monday-Friday, 8:30 AM – 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on (571)272-1657. The fax numbers for all communication(s) is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1625.

/Tram H Nguyen/
Examiner, Art Unit 2818

/Dao H Nguyen/
Primary Examiner, Art Unit 2818
June 5, 2008